TITLE PAGE

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ABSTRACT:

A joint venture between Enerdyne LLC, a small independent oil and gas producer, and Pumping Solutions Inc., developer of a low volume electric submersible pump, suspended from a cable, both based in Albuquerque, New Mexico, has re-established marginal oil production from Red Mountain Oil Field, located in the San Juan Basin, New Mexico by working over 17 existing wells, installing cable suspended submersible pumps (Phase I) and operating the oil field for approximately one year (Phase II). Upon the completion of Phases I and II (Budget Period I), Enerdyne LLC commenced work on Phase III which required additional drilling in an attempt to improve field economics (Budget Period II).

The project was funded through a cooperative 50% cost sharing agreement between Enerdyne LLC and the National Energy Technology Laboratory (NETL), United States Department of Energy, executed on April 16, 2003. The total estimated cost for the two Budget Periods, of the Agreement, was $1,205,008.00 as detailed in Phase I, II & III Authorization for Expenditures (AFE).

This report describes tasks performed and results experienced by Enerdyne LLC during the three phases of the cooperative agreement.

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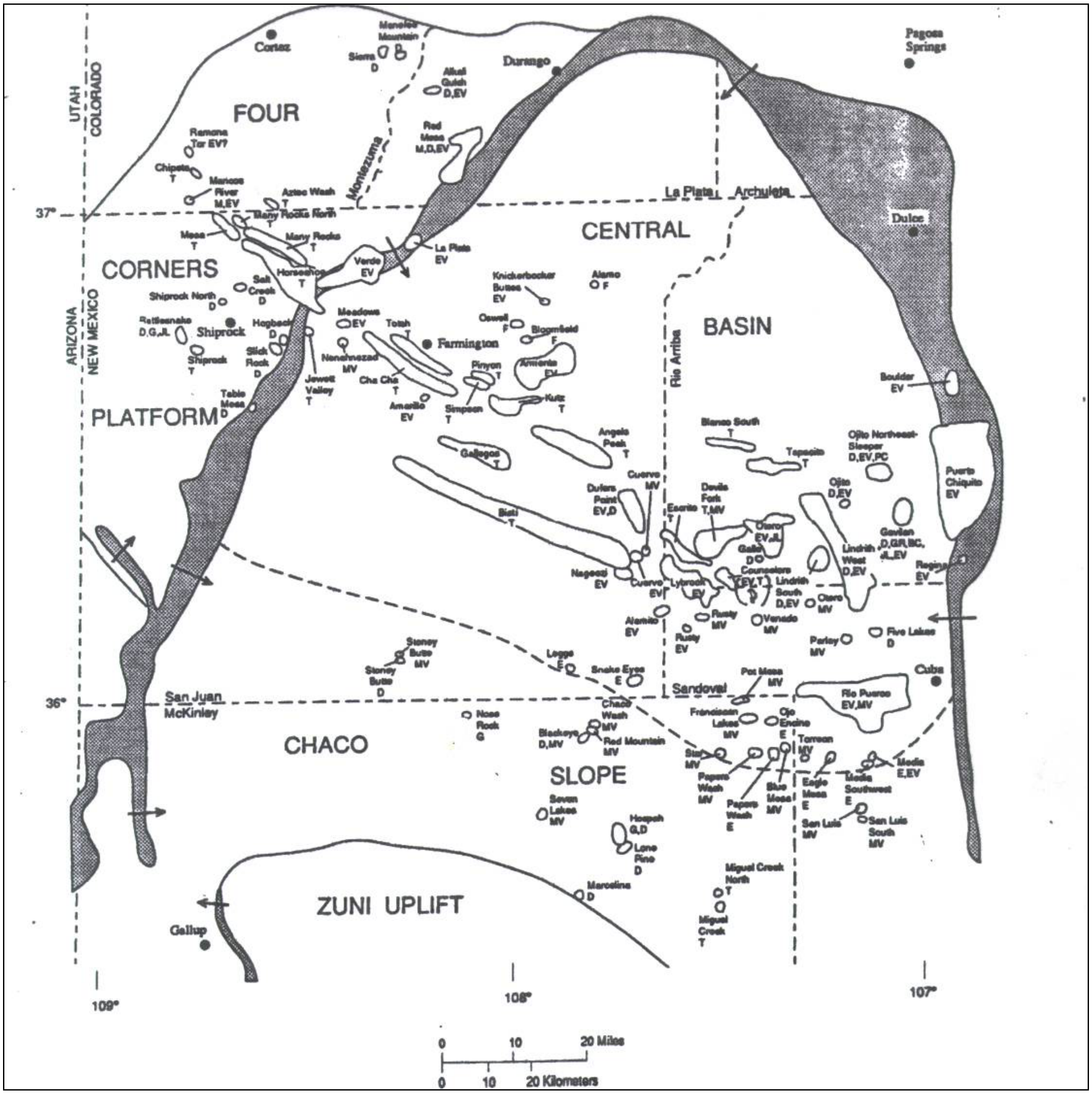
INTRODUCTION

Enerdyne LLC resumed marginal oil production operations in the Red Mountain Oil Field, (P1), located in McKinley County, New Mexico by installing a cable suspended hydraulic diaphragm electric submersible pumping system (HDESP) in 17 selected well bores, determined that the system can reduce lift costs making it a more cost effective production system for similar oil fields within the region, and drilled an additional well to improve the economics.

Three Phases of work were defined in the DOE Form 4600.1 Notice of Financial Assistance Award for this project, in which the project objectives were be attained through a joint venture between Enerdyne LLC (Enerdyne), owner and operator of the fields and Pumping Solutions Inc. (PSI), developer of the submersible pumping system. Upon analysis of the results of each Phase, the DOE determined that the results justify the continuation of the project and approve the next Phase to proceed. This technical report shall provide the DOE with results and conclusions reached by Enerdyne during Budget Period I, which includes all tasks described in Phase I and Phase II (Operations) and the results from Budget Period II, which induces drilling and completing the State 170, a 523 meter (m), (1710 ft.) test located in Section 28, Township 20 North, Range 9 West.

EXECUTIVE SUMMARY

In April, 2003 a cooperative 50% cost share agreement between Enerdyne and the DOE was executed to investigate the feasibility of using cable suspended electric submersible pumps to reduce the lift costs and increase the ultimate oil recovery of the Red Mountain Oil Field, located on the Chaco Slope of the San Juan Basin, New Mexico (M1). The Field was discovered in 1934 and has produced approximately 55,650 cubic meters (m^3), (350,000 barrels) of oil. Prior to April, 2003 the field was producing only a few cubic meters of oil each month; however, the reservoir characteristics suggest that the field retains ample oil to be economic (M2). This field is unique, in that, the oil accumulations, above fresh water, occur at depths from 88-305 meters (m), (290 feet to 1,000 feet, ft.), and serves as a relatively good test area for this experiment.



San Juan Basin Oil & Gas Fields (M1)

Red Mountain Oil Field (P1)

Seventeen well bores were selected by Enerdyne for workover (M3). Wells were selected based on their completed depth, as indicated by existing New Mexico state records, and have, at least a 101.6 millimeter (mm), 4.0 inches (in.), inside diameter to accommodate the Pumping Solutions Inc. (PSI) pump.

Using Enerdyne's rig (P4), conventional methods were employed to cleanout all wells of wall buildup and bottom hole sediment accumulation. Each well was then treated for minor skin damage and circulated. No significant problems were experienced during these procedures. After each well was cleaned, PSI began installing its HDESP system via the Cable Suspended Pumping System (CSPS) trailer (P3). With the exception of one installation, all pumps were eventually installed, tied-in to a temporary power supply and storage tank. The one installation that was not completed, resulted from an unforeseen down hole condition that caused the pump to become diagonal in the well and irretrievable with the CSPS trailer. It was found, that when using a cable to suspend the pump and flexible production tubing, the maneuverability of the pump is extremely limited. Several other pumps had to be pulled and reinstalled because of electrical and chemical problems.

Santa Fe #113 Temporarily Tied-in (P2)

CSPS Trailer (P3)

Following the temporary tie-in procedures each well was pumped until it was determined that the well was stable and reservoir conditions were normalized. The well was then pumped for a period of time to gauge the produced fluid and determine the actual oil cut. It was concluded that, on average a well would produce approximately 1.472 cubic meters per second, (m^3/s), (8 bbls./day) of fluid with a 15% oil cut. Therefore the field could feasibly produce 3.754 m^3/s of oil (20.4 bbls./day).

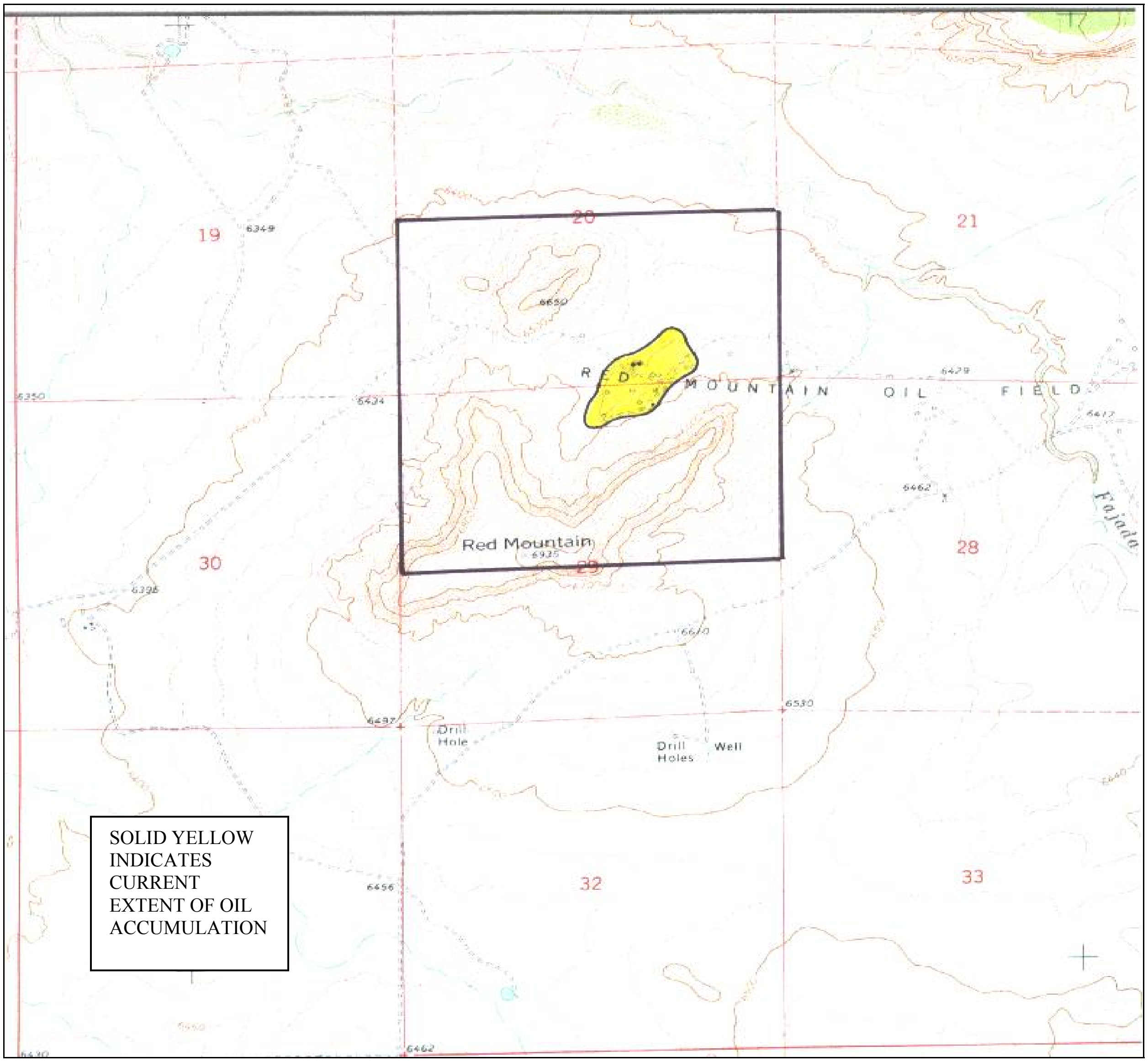
Enerdyne Rig (P4)

EXPERIMENTAL

PHASE I & PHASE II

The objective of Phase I was to attempt to establish marginal oil production. This was accomplished by selecting 17 wells within the oil fields, removing existing equipment when necessary, cleaning out each casing, treating the pay zone of each well for minor skin damage, temporarily installing a HDESP in each well, and determining the oil cut of the production.

The Phase II objective was to operate the field for approximately one year to determine the economics of the experiment.



Red Mountain Topographic Map (M2)

Well Tie-in

After a HDESP was installed, a 101.6mm x 457.2mm x 812.8mm (4in. x 18in. x 32in.) concrete pad, designed with openings to fit around the wellhead and also allow the electric cable and tubing to pass through, was placed over the wellhead, production tubing and power cable, and the well was tied-into a power supply and gathering system. A 20 amp disconnect and 240 volt timer were mounted adjacent to the starter on the wooden post and wired together through plastic flex conduit. A power supply cable was run to the well in a .6096m (2ft.) deep trench, from the main power source, buried and then wired into the disconnect. The production tubing was coupled and run, under ground, to a production tank. The wellhead was then covered by bolting a 203.2mm x 406.4mm x 558.8mm (8in. x 16in. x 22in.) metal box to the concrete base (P5). The location was fenced with pipe panels or t-posts and barbed wire.

Typical Producing Well – Surface Equipment (P5)

Operations

Phase II operations began in November 2003. Because flow lines were not buried at that time, production was limited due to the weather, given the high percentage of fresh water produced.

In March 2004 work was resumed on a normal schedule. All pumps were operational with the exception of one pump that was lost during installation. Most wells produced for one hour per day to accommodate the limited tank volume at that time.

While each well was produced daily, it was required to be shut down production during permanent tie-in operations. This task consumed the summer months. Approximately 1829m (6,000ft.) of electrical cable and flow line were laid and buried within a .6096m (2ft.) deep trench to tie-in the producing wells to production tanks.

In August 2004, all wells were tied-in. Produced fluids were pumped to six tank batteries located within the field where, once the oil and water separation occurred (P6), produced water was drained from the production tank and placed in steel tanks to evaporate and or to be stored until other methods of disposal could be approved by the New Mexico Oil Conservation Division. The field was produced continually up to November 2004 and intermittently through the winter months until March 2005 at which time continual production resumed.

RESULTS

HDESP

Once the HDESP system was installed and tied-into a production tank, pumping operations, regarding the system, were not at all labor intensive: wells were checked to confirm that the down hole pump was operational and that the well head had not developed any leakage from the flow line connection. Unlike the typical beam pump, no surface equipment with moving parts required attention: there were no fluids to check, no bearings nor seals to lubricate nor belts or bolts to tighten. One man was able to check all wells within two hours.

However, at the end of the Phase II operations only 13 pumps were operational. One pump was lost during installation and three others failed due to apparent down hole electrical problems.

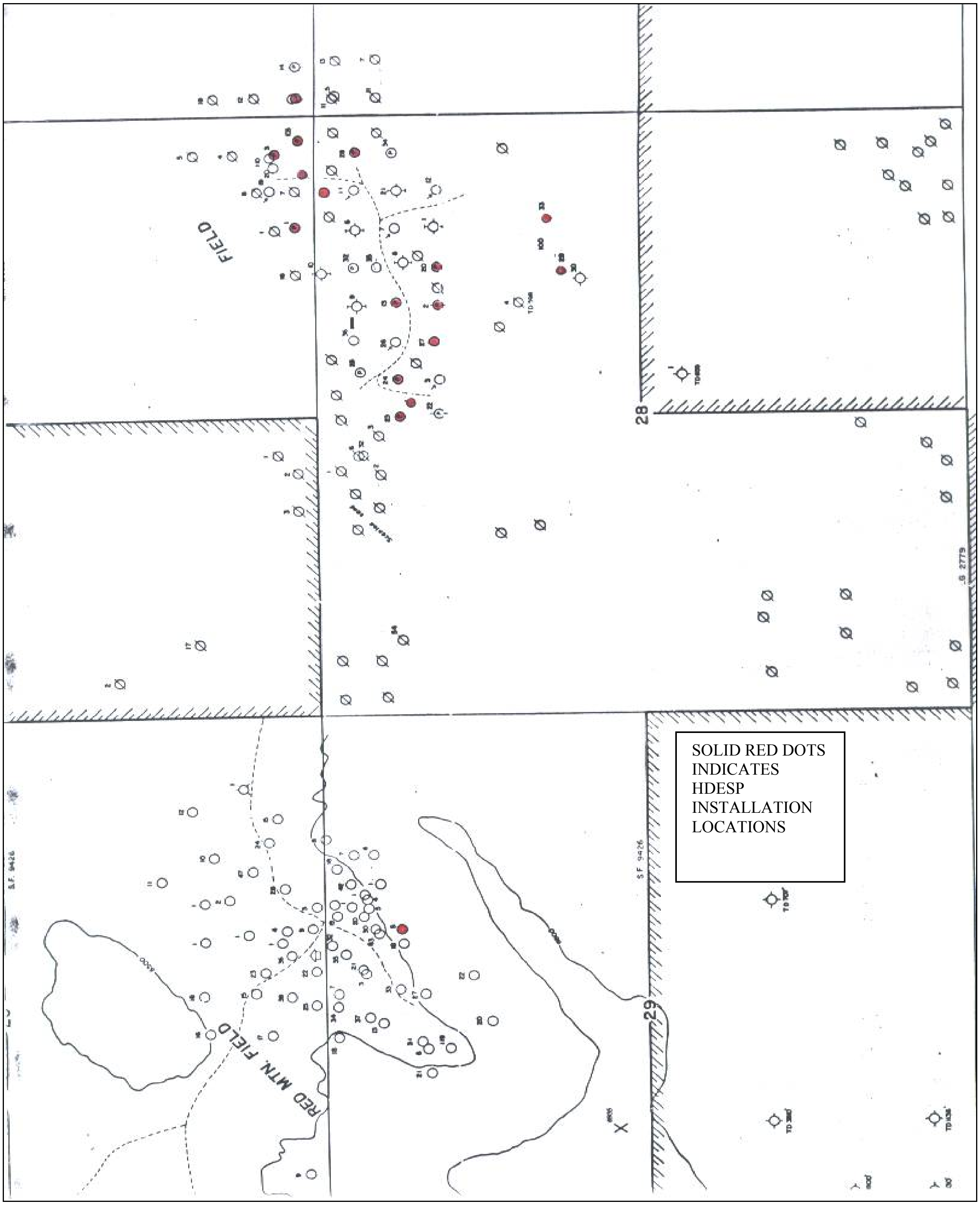
In summary, in spite of the pump failures, the HDESP system was found to have several advantageous features:

- the HDESP system was able to pump acid, solids and fine sand without pump failure
- the pump was able to pump off without pump failure
- the HDESP system can be installed or removed in one third of the time required by conventional methods

- the HDESP pump can be tie-into rigid or flexible tubing
- the HDESP system eliminates costly surface equipment with moving parts
- the HDESP system can be solar operated therefore used in remote locations
- the HDESP system operates for approximately half the cost to power a conventional surface mounted electric motor
- the HDESP system reduces pumper man hours by 60%

Conversely, the HDESP system can create a unique set of potential problems during operations:

- the HDESP system can not be maneuvered in the well bore with flexible tubing
- differential stretching of the HDESP system components can cause the suspension cable to cut into or pinch off the flexible tubing during production
- the pulsating action of the HDESP pump can cause the suspension cable, tubing and or the electrical supply line to wear against the casing
- the HDESP pump is susceptible to failure from numerous electrical conditions above ground and down hole
- the HDESP system can be easily damaged during installation or replacement by typical oil field personnel
- the CSPS trailer is required to install or remove the system cost effectively
- the HDESP pump can not be repaired in the field



Red Mountain Base Map (M3)

Production

The original plan for oil production was to allow each well to pump for a couple of days or until the well was pumped off and then calculate the oil cut to determine economics. It was found that the typical well makes 1.272m^3 (8 + bbls.) of fluid per day for the first month of initial pumping, with the well pumped for two hours per day. The average oil cut was calculated at approximately 15%. Within a few weeks of pumping, the production tanks were full and produced water would have to be disposed to resume production. Once all wells were online, it was apparent that the volume of produced water was too great to manage; therefore, four additional tanks were set within the field and one existing 184 m^3 (1000 bbl.) tank was converted to produced water storage.

After three months of daily pumping, fluid volumes decreased to approximately .447m^3 (3+ bbls.) of fluid per day when pumping 1 hour per day. Aggregate oil cut was approximately 8%. Although several wells were capable of substantially more volume, it was difficult to keep up with the produced water. As a result of the shallow lenticular nature of the reservoir, by April 2005, production from five wells fell to less than 1.84 m^3 (1 bbl.) of fluid per day with a 5% oil cut.

Economics

With current higher oil prices and the low cost to operate, the field is marginally profitable. Oil production is approximately .362m^3 (2.5 bbls.) per day with the potential of 3 m^3 (20 bbls.) per day once all wells are allowed to produce on a regular extended schedule along with additional drilling.

Electricity consumed during an average month of production was 540 kwh which is less than $200.00 per month or $12.50 per well per month with 16 wells pumped 1 hour per day.

The produced water remains as a significant economic element. Because the Red Mountain produce fresh water and oil, the disposal plan for produced water will provide improved economics if it is designed to employ the produced fresh water in a beneficial use either down hole or on the surface.

PHASE III

Geology

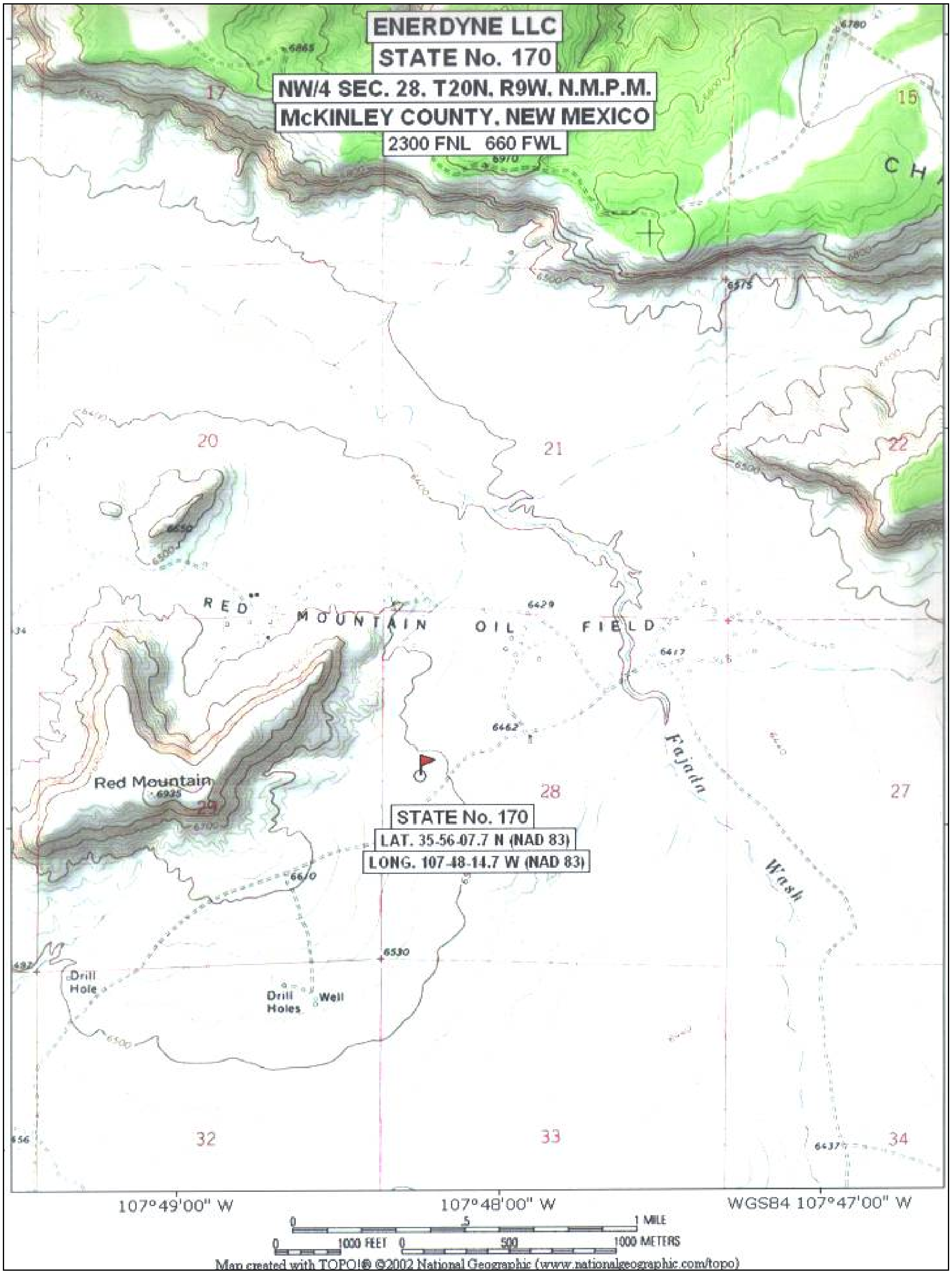
Centered in the southwestern part of Township 20 North, Range 9 West, McKinley County, New Mexico, Red Mountain is located on the Chaco Slope close to the southern rim of the Central or deeper San Juan Basin, a major Laramide structural feature. Red Mountain is a topographic erosional remnant that is situated on the Red Mountain Anticline. This structure is one of several anticlines located on the Chaco Slope, most of which produce or have produced hydrocarbons.

Production from these structures has been predominantly oil from Createceous-aged reservoirs. As part of the upper Mesaverde Group of the San Juan Basin, the stratigraphy of the continental Menefee Formation is a relatively complex series of channel sandstones, shales and coal beds deposited in a near shore lagoonal or swamp environment ranging from a thickness of 164 m (500 ft.) in the northwestern part of the basin to over 656 m (2000 ft.) in the southern part of the basin. Reservoir characteristics for a Menefee pool average 25% porosity and permeability of 200 to 500 millidarcies (μm^3). The Menefee Formation, in the Red Mountain area, is present at the surface to a depth of approximately 525 m (1600 ft.).

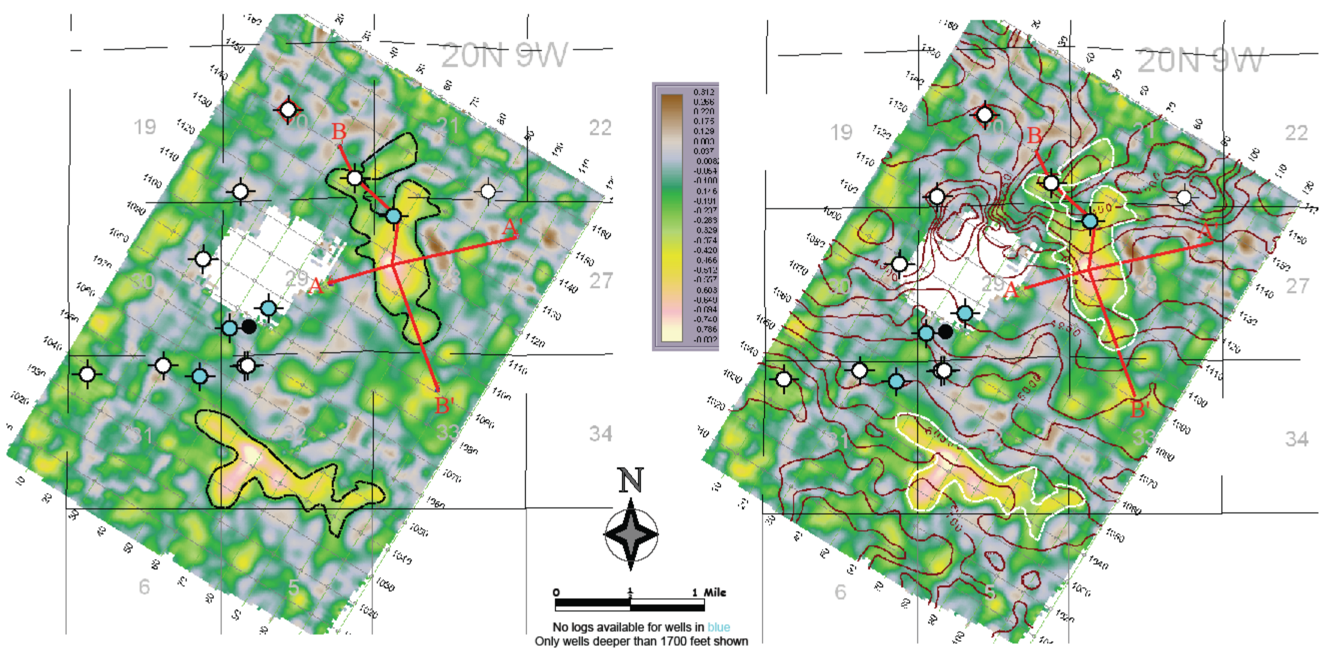
Current Red Mountain production, including the 17 wells selected for this project, is from shallow fluvial Menefee sandstones that are situated on subtle subsidiary closures on the plunging north nose of the Red Mountain anticline. Low reservoir energy and oil-freshwater surface tension due to the shallow depths of the sandstones, present a recovery challenge that Enerdyne is currently attempting to meet.

Location Selection

To improve the marginal economics of the Red Mountain Field, Phase III funding was directed toward drilling an additional well in April 2006. The State 170, located in the northwest corner of Section 28, Township 20 North, Range 9 West, NMMP, McKinley County, New Mexico, a 523 m (1710 ft.) test (M4), was picked as the result of the interpretation of a 14.48 square kilometer (km) (9 square miles) 3D seismic survey shot over the Red Mountain area (P6).



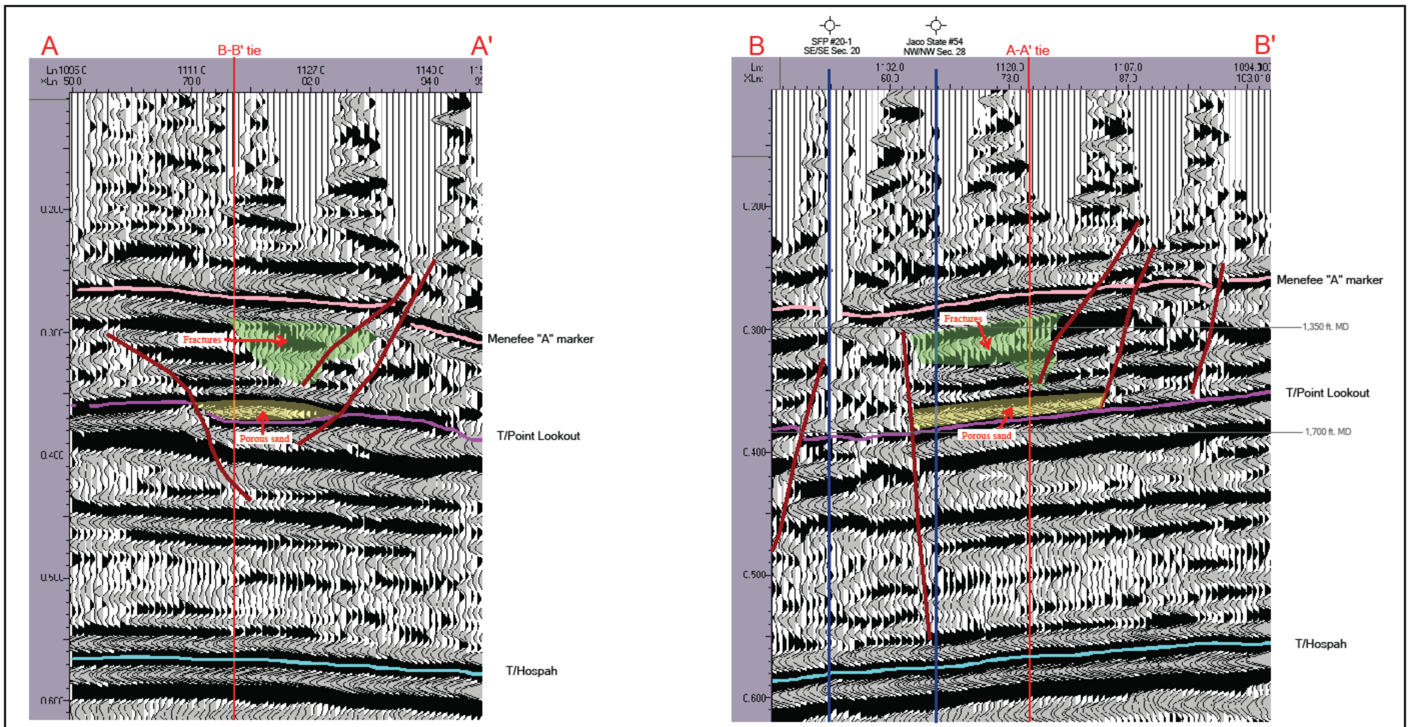
State 170 Location Survey Map (M4)



AMPLITUDE MAP, BASAL MENEFEE
(window within 8 msec above top of Point Lookout)

Low amplitude anomaly related to possible gas-filled porosity

AMPLITUDE MAP, BASAL MENEFEE
(window within 8 msec above top of Point Lookout),
with subseas on top of Point Lookout
C. I. = 25 ft.



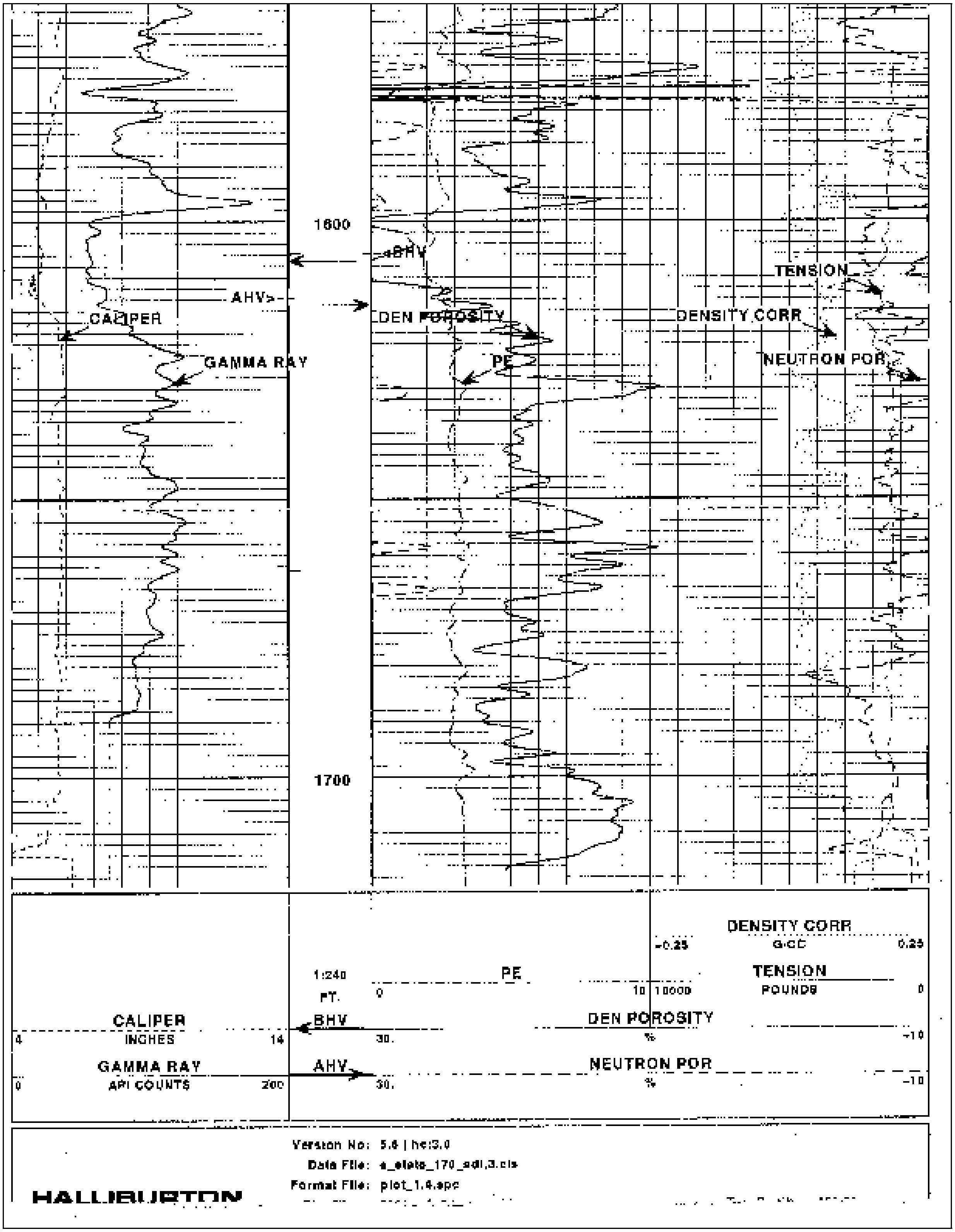
While completing a seismic review of the Cretaceous Point Lookout Sandstone, a regressive-marine shoreface sandstone deposit, which stratigraphicly lies directly below the Menefee, Enerdyne's consulting geologist identified an interesting set of amplitude anomalies sitting on top of the Point Lookout in the basal Menefee. The anomaly that is located in the west half of Section 28 was selected because it illustrates an extra section of sandstone sandwiched by listric faults (P6). Further, the anomaly is particularly appealing because the top of the Point Lookout forms a flat bottom, positive reflector, and a secondary, convex or upward, positive reflector lies above it. Between the two is a low amplitude trough as shown with seismic section A-A'. What the curved upper reflector suggests is a gas-rock interface, and the specific type of flat bottom-to-convex upward peak pair is common in gas-bearing reservoirs. The anomaly is seen on section B-B' rising updip to the south, which is regional dip out of the San Juan Basin. The amplitude map with the Point Lookout structure contours, superimposed, generated from well tops and seismic data, shows that the State 170 location is 25 m (75 ft.) to 30 m (100 ft.) updip of the two dry holes that are seen on the north or downdip side of the anomaly.

In addition, the State 170 location provided an opportunity to generate several plug back horizons given the indication of fractured shale above the 525 m (1600 ft.) target and the many sands and coals that are also present within the Menefee Formation.

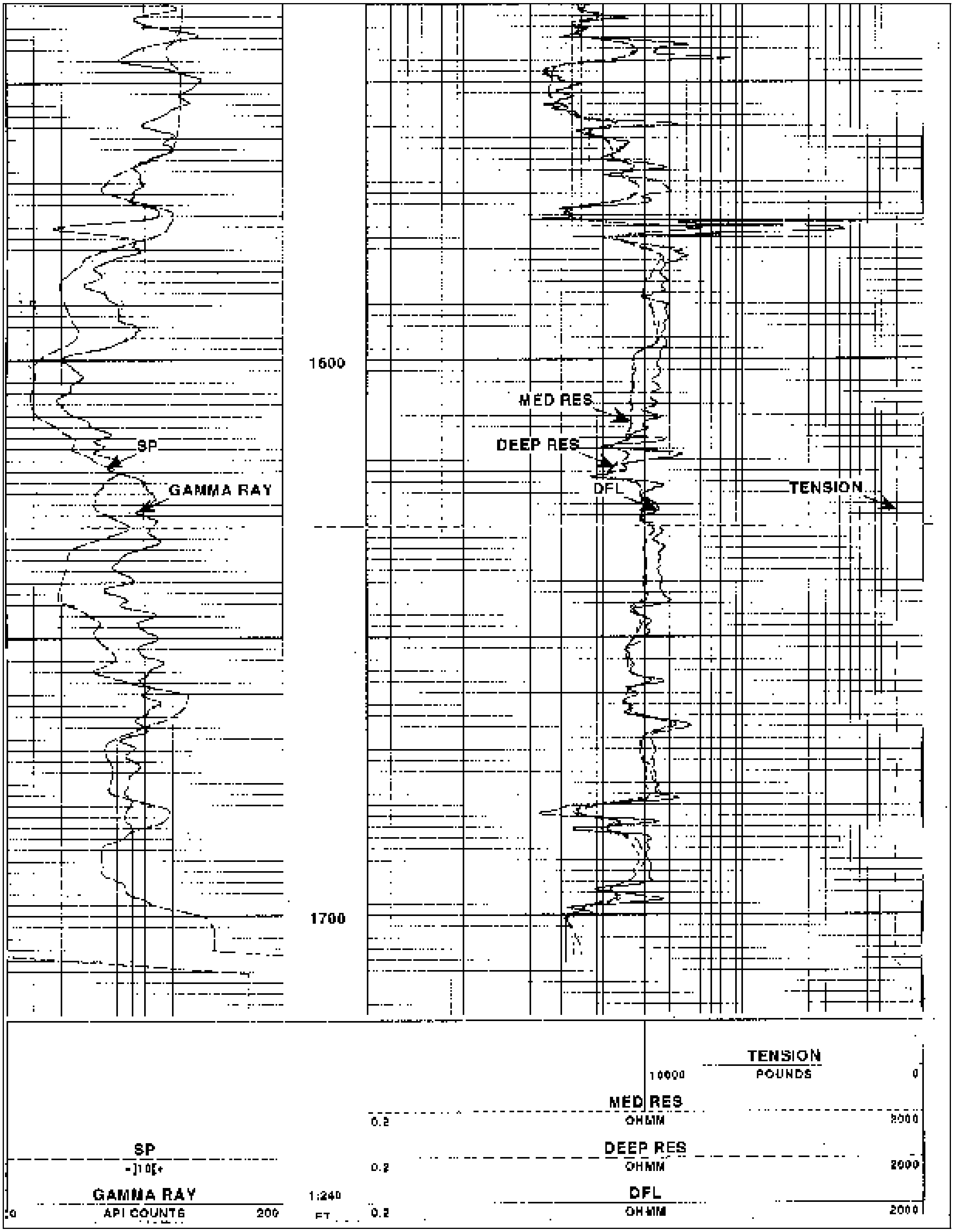
Drilling

Employing S & S Drilling's trailer mounted Failing 2000 rig, on April 17, 2006 the State 170 was spudded. A 222 mm (8.75 in.) hole was drilled to 44.29 m (135 ft.) from surface and 41.67 m (127 ft.) of 178 mm (7 in.), 17# surface casing was landed and cemented to surface with 60 sacks of class "B" cement. Drilling of a 159 mm (6.25 in.) hole then commenced after the surface casing was pressure tested at 600 psi for 30 minutes, using fresh water, bentonite and polymer as drilling fluid. The hole was drilled to a depth of 561 m (1710 ft.) from the surface, conditioned and logged on April 28, 2006.

Upon review of the Spectral Density Dual Spaced Neutron Log (I1) and the High Resolution Induction Log (I2), the primary target was confirmed as well as other possibilities in upper sands. The Point Lookout sand from 524.6 m (1599 ft.) to 528.5 m (1611 ft.) illustrates good total porosity and good resistivity separation for shaly sands with possible gas plus oil present. Therefore on May 5, 2006 the hole was conditioned and cased with 114 mm (4.5 in.), 10.5# steel casing to 599 m (1705 ft.) from surface, flushed with 1.91 m^3 (12 bbls.) of gel water at 200 psi and cemented with 103 sacks of lead class "B" cement slurry at 450 psi and followed with 77 sacks of class"B" cement slurry circulated to surface at 500 psi. The cement within the casing was then displaced with 4.29 m^3 (27 bbls.) of water at 700 psi, bumped plug against float, at 552.5 m (1684 ft.), with 1000 psi and held for two hours.



Spectral Density Dual Spaced Neutron Log (I1)



High Resolution Induction Log (I2)

Completion

On July 26, 2006 the production casing was tested to 600 psi and held for 30 minutes. Using Enerdyne's rig, the bottom of the hole was tagged at 552.5 m (1684 ft.) with 53 joints of 60 mm (2 3/8 in.) upset steel tubing. Circulating through the tubing, the existing casing fluid was displaced with 3.975 m^3 (25 bbls.) of KCL water, the tubing was pulled out of the hole, and the casing was topped off leaving it completely full of KCL water. On July 27, 2006 the casing was perforated with four 9.5 mm (.375 in.) shots per .305 m (foot) from 524.6 m (1599 ft.) to 526.25 m (1604 ft.) GR. The perforating tools were pulled from the hole and the well was capped waiting on the HDESP system to be installed by PSI.

State 170 Well Sign and Location (P7)

Testing and Production

The Point Lookout Sandstone is not a prolific producer on the Chaco Slope. There was no production of hydrocarbons from the 525 m (1600 ft.) sand, within the Red Mountain area nor was there any within the immediate several kilometers adjacent to the Red Mountain, consequently, the service companies were unable to recommend a completion procedure. Given the lack of an analog of the reservoir characteristics, the high porosity and permeability exhibited on the logs, and the possibility the well could produced oil, as well as the existing plug back potential, it was decided that production equipment would be installed and the well would be produced to determine its potential. If the well produced oil, the produced fluids would then be analyzed to determine if and how the reservoir should be stimulated. Thus, the plan was to install the HDESP system and allow the well to produce. After recovery of fluids introduced into the reservoir during drilling and completion, and if the well produced oil, a decision would then be made regarding stimulation.

In 2005 PSI was acquired by Smith Technologies, forming Smith Lift. The PSI location in Albuquerque, New Mexico was vacated and the key principal was transferred out of state. During this transformation, Enerdyne acquired a HDESP system intended for use in the State 170, however the only two qualified individuals that were capable of providing immediate assistance with the HDESP system were no longer available for this project.

Enerdyne decided to produce the well and that the HDESP system would be installed, it was determined to set the pump just below the perforation, at 528.2 m (1610 ft.), in the event the well made gas. Accordingly, the system components were reviewed for an installation to this depth and, as a result of prior pump installations, more specifically the inability to maneuver the pump in the casing, Enerdyne elected to install the pump using 31.75 mm (1.25 in.) upset steel tubing instead of suspending the pump from a steel cable and producing through flexible tubing.

The electrical requirements to operate the pump equipped with a single phase, two horse power submersible electric motor, at a depth of 525 m (1600 ft.) were also calculated. It was computed that minimum gauge submersible electric cable would have to be a #4 copper wire. At this point in time the price of copper had risen 400% from the commencement date of this project. This increase in the price of copper added more than $6,000.00 to the cost of the HDESP system. In addition, the size of the submersible electric cable would make it extremely susceptible to damage during installation given the manner in which the cable connected to the pump. In order to deal with these circumstances, the system was converted from 230 volt, single phase to 460 volt, three phase. The submersible electric motor on the pump was replaced with a two horse-power, 460 volt, three phase motor, a three horsepower, 460 volt, three phase, magnet starter was employed along with a 230 volt, single phase/ 460 volt, three phase converter. Implementing this electrical configuration, the HDESP system could be operated by the use of a #10 copper cable and the system would consume less power to operate.

The HDESP system was scheduled to be installed in the well in September 2006 with the assistance of former PSI employees. The day before the system was to installed, the pump was tested, at Enerdyne's Albuquerque shop, to insure that it was operational prior running the system in the well. When the pump was started, the hydraulics blew apart due, apparently, to an internal valve not opening properly. In an effort to repair and or replace the pump, Smith Lift was contacted. This attempt was in vain, because of the experimental nature of the pump, no parts were available and the pump could not be repaired. The HDESP system installation was abandoned.

In October 2006, Enerdyne's rig was employed to run conventional rods and tubing in the State 170. A .914 m (3 ft.) perforated 60 mm (2 3/8 in.) sub and a .3048 m (1 ft.) seating nipple were run into the well in front of 527.56 m (1608 ft.) of 60mm (2 3/8 in.) upset tubing. A 50.8 mm x 31.75 mm x 2.62 m (2in. x 1.25 in. x 8 ft.) insert pump was set into the seating nipple with 19.05 mm (.75 in.) rods. A used CMC 57 pumping unit powered by a Fairbanks gas motor was installed. A 2.27 m^3 (600 gal.) propane tank was set to fuel the Fairbanks motor. The flow lines from the well head were tied-in the well was produced as the weather permitted (P10).

CMC 57 (P8)

The State 170 has produced intermittently since December 2006. Initial production from the 525 m (1600 ft.) sand was 13.5 m³ (85 bbls.) of water per day with a trace of gas and oil.

Road to State 170, December 2006 (P9)

CONCLUSIONS & RECOMMENDATIONS

Enerdyne has reached the conclusion that the cable suspended pumping system, such as the HDESP, when installed in a shallow reservoir, such as the Red Mountain Oil Field, can be a more cost effective artificial lift method than the conventional rod pump method and therefore provides an operator the opportunity to extend the life of a similar field by reducing man hours to pump wells and by lowering the energy cost to operate. Because a submersible pump system eliminates the need for expensive surface equipment that requires constant maintenance, pumping labor costs are reduced by 60% ; this, coupled with the reduced electricity cost savings of approximately 45% to operate, creates a significant comparative cost advantage for the HDESP. Clearly, when the cost to pump a marginal well is reduced, the impact of any operating cost savings is substantial to the economic life of the that well, which is the case within the Red Mountain Oil Field .

However, when a pump fails, the HDESP system cost effectiveness is reduced and or eliminated, when a comparison of the pull and run costs is made between HDESP and the conventional rod pump method. Using the line item costs from the AFE for Phase I, the cost to pull and replace a conventional rod pump would run approximately $2,750.00: rig cost for one day of $2,000.00 and allowing $750.00 for a rebuilt 31.75 mm x 1.83 m (1 ¼" x 6') rod pump, compared to $4,750.00 for one day use of the ESPS trailer ($750.00) and a submersible pump replacement ($4,000.00). For that reason and as a result of the number of pump failures experienced during Phase II, Enerdyne would recommend that certain pump design elements, mainly electrical components and connections, require additional research and development. In addition, quality control during pump assembly probably needs refinement as well, in order to achieve a level of pump reliability that is essential to the oil field.

It is further recommended that the HDESP not be installed with a suspension cable and or flexible production tubing in a 114.3 mm (4 ½") well casing. The lack of pump to wall clearance, with the current PSI pump design, is susceptible to pump hang up or loss and damage to the production tubing from twisting, crimping or abrasion. A 139.7mm (5 ½") well casing installation lends itself to less adversity but in order to do away with most of the installation and production problems associated with the HDESP, it is recommended that future submersible pump installations be with rigid tubing such as 31.75 mm (1 ¼") schedule 80 PVC or upset steel tubing. By doing so, the required surface equipment would not change and the pump would not have to be pulled with the CSPS trailer but could be pulled with more familiar field equipment such as a water well winch truck or a small drill rig. There would also be a material cost benefit of more than 50% from the substitution: 31.75 mm (1 ¼") schedule 80 PVC with galvanized couplings or used 31.75 mm (1 ¼") steel upset tubing would cost $1.00 per foot compared to $2.12 per foot for 6.35 mm (¼") stainless steel cable and 15.88 mm (5/8") high pressure neoprene tubing.

Lastly, regarding the HDESP system, Phase III illustrated the experimental consequences associated with the HDESP system, and demonstrated that cost benefits rapidly go away for low volume electrical submersible pumps, when compared to conventional pumping system, in a normal deeper well application, due to the higher price of copper, cost of the pump and equipment, and potential damage that can occur when running the systems in and out of a well.

Phase III was a challenge for a collection of reasons and the results from the State 170 are not as anticipated. Obviously, as is the case with this project, the higher price of oil proved to have more of an impact on the economics than any other factor. However the higher price has a double edged effect. This economically marginal oil property become profitable and a longer lived venture when the commodity doubles or triples in price. Then again, the cost to drill and to operate increased commensurately as a result of supply and demand. In general, Enerdyne experienced delay after delay from the lack of available equipment and experienced personnel and cost overruns, for most line items, due to price increases for materials and by service companies and for fuel surcharges.

It appears that the well may produce gas once the hydrostatic pressure is reduced, but at this point in time, the well is making approximately 13.5 m^3 (85 bbls.) of water per day that requires deposal. If water production remains at this level, the 525 m (1600 ft.) sand will be abandon and Enerdyne will test the upper four Menefee sands that appear, from log analysis, to contain hydrocarbons.

REFERENCES

Budget Period I & II Authority For Expenditures (attached)

AUTHORIZATION FOR EXPENDITURE RED MOUNTAIN PHASES 1 AND 2	DATE VARIOUS	RED MOUNTAIN 290-450 SAND	LEASE NAME RED MOUNTAIN
LOCATION SECTIONS 20, 21, 22, 27, 28 & 29, T-20-N, R-9-W	WELL NOS.	TD	FORMATION MENEFEE
OPERATOR ENERDYNE LLC	COUNTY MCKINLEY	STATE4 NEW MEXICO	AFE NO. TOTAL
PURPOSE FOR EXPENDITURE PRODUCE MENEFEE SAND USING PSI PUMPS	TYPE OF WELL OIL	LEASE NO.	WORK DATE VARIOUS

INTANGIBLE COSTS	TIE IN COMPLETION	OPERATIONS	COMPLETED COST
COMPLIANCE	$26,750.00	$45,000.00	$71,750.00
LEGAL FEES & TITLE OPINIONS	2,000.00	-	2,000.00
SURVEY & STAKING	16,500.00	-	16,500.00
SURFACE DAMAGES	2,000.00	-	2,000.00
ADMINISTRATIVE OVERHEAD	33,000.00	30,000.00	63,000.00
PLUGGING BOND	-	4,000.00	4,000.00
MOVE IN & OUT, RIG UP	12,500.00	-	12,500.00
FOOTAGE	49,500.00	-	49,500.00
DAY RATE $2,000.00/ DAY	68,000.00	-	68,000.00
BITS, REAMERS, DRILL PIPE	600.00	-	600.00
ELECTRICAL SURVEY, OPEN HOLE LOG	-	-	-
DRILL STEM TESTS	-	-	-
CORING, SWS, ANALYSIS	1,500.00	-	1,500.00
MUD, ADDITIVES, DIESEL & PKR FLUID	4,900.00	-	4,900.00
CEMENTING: SURFACE 0 FT.-	-	-	-
INTERMEDIATE	-	-	-
OIL STRING 4.5" -	-	20,000.00	20,000.00
FLOAT EQUIP, CENTRALIZER	-	2,200.00	2,200.00
PERFORATING AND RADIO ACTIVE LOG	-	-	-
SWAB, BAILING, W.O. & COMPLETION CSPS UNIT	12,750.00	40,750.00	53,500.00
FRAC OR ACID-STIMULATION	4,250.00	3,000.00	7,250.00
STIMULATION TANK	7,650.00	2,350.00	10,000.00
MISCELLANEOUS LABOR	29,500.00	49,250.00	78,750.00
ROADS, FENCING, LOCATION & PITS	6,890.00	-	6,890.00
WELL SITE GEOLOGIST	12,500.00	-	12,500.00
PETROLEUM ENGINEER	-	1,600.00	1,600.00
MUD LOGGING	-	1,200.00	1,200.00
COMMUNICATIONS	4,550.00	-	4,550.00
TRANSPORTATION & EQUIPMENT HAULING	21,500.00	45,000.00	66,500.00
ABANDONMENT, PLUGGING, & RESTORATION	33,000.00	-	33,000.00
FUEL, POWER, & WATER	13,500.00	13,250.00	26,750.00
SPECIAL SERVICES & RENTALS	25,100.00	6,900.00	32,000.00
OVERHEAD	11,000.00	34,000.00	45,000.00
CONTINGENCY	20,000.00	21,500.00	41,500.00
SUB-TOTAL	$419,440.00	$320,000.00	$739,440.00
TAX	24,379.95	18,600.00	42,979.95
TOTAL INTANGIBLE COSTS	$443,819.95	$338,600.00	$782,419.95

TANGIBLE COSTS	COMPLETION	OPERATIONS	COMPLETED COST
CASING: COND FT.	$0.00	$0.00	$0.00
SURF	-	-	-
INTER FT.	-	-	-
PROD	-	12,000.00	12,000.00
LINER	-	-	-
TUBING	-	6,000.00	6,000.00
RODS	-	-	-
WELL HEAD & SURFACE	-	5,000.00	5,000.00
SURFACE FLOAT EQUIPMENT	-	-	-
POLISH ROD ASSEMBLY	-	-	-
PRODUCTION PACKER	-	3,000.00	3,000.00
DOWN HOLE PUMP	-	213,150.00	213,150.00
SEPARATOR	10,000.00	-	10,000.00
TREATER	-	-	-
VALVES, FITTINGS, CHOKES AND GAUGES	6,250.00	2,000.00	8,250.00
PRODUCTION TANKS	25,000.00	-	25,000.00
WATER DISPOSAL TANK	30,000.00	-	30,000.00
GATES, FENCES AND SIGNS	7,500.00	6,500.00	14,000.00
TRIPLEX PUMP	-	-	-
POWER MOVER (SIZE AND TYPE)	-	-	-
ELECTRICAL EQUIPMENT	33,750.00	-	33,750.00
LINE PIPE & CONNECTIONS	30,000.00	2,500.00	32,500.00
ANCHORS	-	-	-
INSURANCE	3,750.00	-	3,750.00
CONTINGENCY	2,500.00	2,500.00	5,000.00
SUB-TOTAL	$148,750.00	$252,650.00	$401,400.00
TAX	8,646.09	14,685.28	23,331.38
TOTAL TANGIBLE COSTS	$157,396.09	$267,335.28	$424,731.38
TOTAL WELL COST	$601,216.04	$605,935.28	$1,207,151.33

APPENDIX

NETL F 510.1-5 (attached)